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Original article

Transmetatarsal amputation: an 8-year experience

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This study retrospectively reviews an 8-year consecutive series of transmetatarsal amputation (TMA) for forefoot ischaemia in diabetic and non-diabetic patients. Forty-one patients had TMA. Peri-operative mortality was 17% (7/41). A healed stump was achieved in 19 patients (46%) and 18 of these patients were independently mobile, or mobile with sticks. Non-diabetic patients (8/12) healed significantly better than diabetics (11/29). Median time to healing was 7 months (range 3–20 months). All non-healed survivors had a higher amputation (14 below-knee, 1 Syme's).

A healed TMA gives good mobility, but prediction of who will heal after operation is unreliable. Time to healing is often lengthy, and failed healing results in higher amputation. These issues need to be fully discussed with the patient who is considered for TMA.

Key words: Transmetatarsal amputation – Diabetes – Peripheral vascular disease

Transmetatarsal amputation (TMA) was originally performed for trench foot, but recently it has been used increasingly in the treatment of both diabetic and atherosclerotic patients with forefoot tissue loss or infection.[1,2] In performing any lower limb amputation, a balanced compromise is reached between more proximal amputation, with a greater probability of stump healing, and a more distal level of amputation, which carries a greater likelihood of successful rehabilitation and mobility.

Rehabilitation following major lower limb amputation (above or below-knee amputation) for peripheral vascular disease is rarely successful. Only approximately 5% of amputees will be able to walk safely outside the home with their prosthesis.[3] The majority of amputees who are initially mobile with a prosthesis will be wheelchair-bound at 5 years.[4] Potentially, TMA offers a greater prospect of rehabilitation and mobility with a useful stump. It has theoretical benefits for patients with ischaemia or infection limited to the forefoot.

We report our experience with TMA in a consecutive series where the decision for amputation was based on clinical grounds alone.

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Patients and Methods

Consecutive patients undergoing TMA over an 8-year period from January 1991 to December 1998 were studied. Details of patients having undergone TMA were obtained from operating theatre ledgers and patient's individual hospital records.

Forty one patients (37 men; 4 women) underwent a transmetatarsal amputation. The median age at time of TMA was 71 years (range 40–91 years). Of the 41 patients, 29 (71%) were diabetic. Other cardiovascular risk factors included ischaemic heart disease in 12 (29%), atrial fibrillation in three (7%) and cerebrovascular accident in two (5%).

The indication for the operation was gangrene in 31 cases (76%) and unhealed ulceration in 10 (24%). Of those presenting with gangrene, 8 patients had gangrene affecting one toe only, 15 had gangrene affecting 2–4 toes, and in 8 patients all toes were gangrenous. In 19 cases, gangrene extended to metatarsal heads. Osteomyelitis was confirmed on MRI scan in 3 patients.

In addition to clinical examination, all patients had measurement of ABPI and 31 patients had intravenous digital subtraction angiography to assess the possibility of revascularisation. The level of amputation was decided on clinical grounds not on the basis of angiography. MRI of the foot was carried out in the presence of cellulitis or when extent of disease was not clear clinically.[5] All patients with cellulitis, extensive ulceration or wet gangrene were treated with intravenous flucloxacillin, metronidazole and cefuroxime. Arterial revascularisation was carried out in 20 patients: 9 underwent percutaneous transluminal angioplasty (PTA), femoropopliteal bypass was performed in 9 patients and femorotibial bypass in 2.

All amputations were carried out at the mid-metatarsal level with preservation, whenever possible, of a long plantar flap. In 19 patients (46%), the skin flaps were closed directly and in the remainder the wound was left open and allowed to heal by secondary intent.

Statistics

Statistical analysis was carried out using Chi squared test with Yates's correction for small numbers.

Results

Peri-operative 30 day mortality was 17% (7/41). All of these patients had a non-healing amputation at the time of their death. All deaths were as a result of pre-existing co-morbid conditions (myocardial infarction 6, CVA 1). A further 4 patients died during the first year after operation.

Table 1 Differences between healed and non-healed patients after TMA

	Healed (n= 19)	Non-healed (n = 22)	
Diabetes mellitus	11	18	$P < 0.001$
Revascularisation			
PTA	5	4	NS
Bypass	6	5	NS
Primary closure	9	10	NS
Mortality			
30 day	0	7	$P < 0.005$
1 year	1	3	NS
Proximal amputation	0	15	$P < 0.001$

NS, not significant.

Nineteen wounds (46%) completely healed at a median time of 7 months following operation (range 3–20 months). There were no differences in rates of healing occurring in those patients having revascularisation or primary closure (Table 1). Non-diabetic patients healed significantly better than diabetic patients. Eleven out of 29 diabetic patients healed compared with 8 out of 12 non-diabetic patients ($P < 0.001$, Chi squared 17.8, df 1). The reason for failure of healing was progression of gangrene or cellulitis.

Once patients had achieved a healed stump, none required a more proximal amputation. However, all of the surviving patients with a non-healed amputation stump required amputation at a higher level (14 below knee [BKA] and 1 Syme's amputation).

At the time of follow-up, of those patients with healed TMAs, 14 were fully mobile and pain-free, and 4 were mobile but with walking sticks. Only one patient was unable to mobilise without a wheelchair or frame.

Discussion

The role of transmetatarsal amputation in the treatment of the critically, ischaemic foot remains uncertain. It is clear from this and other studies,[6,7] that those patients who achieve a healed transmetatarsal amputation have good mobility, particularly compared with the disappointing rehabilitation results for major above or below-knee amputations.[4] Of patients with a healed TMA, 74% were independently mobile and, overall, 95% of patients whose wounds healed achieved independent mobility or mobility with sticks. The problem remains that one cannot predict who these patients will be. Attempts to predict the level of successful amputation have been largely unsuccessful,[8] and clinical judgement appears to be as reliable a

method as any.[6] In this study, selection for TMA was made on clinical grounds, without expensive or time-consuming non-invasive tests, and the TMA failure rate was comparable to other reported series.[6,7,9]

TMA need not be confined to the diabetic patient as originally advocated. Non-diabetic patients healed significantly better in this series, and the technique of TMA can be applied equally to diabetic or atherosclerotic disease of the forefoot. The increased risk of spreading sepsis in the diabetic patient may make this group more susceptible to failure leading to a subsequent higher amputation rate.

Peri-operative mortality for our series was 17%. This is higher than other series which report operative mortality rates of 2–3%, [6,10] but our patients are a consecutive, non-selected series many of whom are global arteriopaths. This mortality rate is comparable to the peri-operative mortality for major lower limb amputation.[11] TMA cannot, therefore, be considered to be a minor undertaking with little risk for the patient.

In these days of informed consent, it is difficult to know, on the basis of this and other studies, how to advise patients on the relative merits of TMA. The choice lies generally between TMA or a below-knee amputation. If the transmetatarsal amputation heals, then the patient will have good mobility. Unfortunately about half will fail to heal and require a higher amputation. Honest clinicians will admit that they do not know which TMAs will do what. Time to healing for TMA is often lengthy, and condemns the patient to many months of dressings and discomfort. This has to be balanced against the option of a primary BKA which has a greater likelihood of healing, but worse potential for mobility than a healed TMA.

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